# CROWTH OF THE CYPRINID FISH, *BARBUS LUTEUS* (HECKEL) IN THARTHAR RESERVOIR, IRAQ

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*Barbus luteus,* locally known as "himri" represents one of the commercially important fresh water fishes in Iraq. This fish inhabits a wide range of habitats from the marshes in the South to the Tharthar Reservoir at North-West of Baghdad. Save and except the study of Bhatti and Al-Daham (1978) on the annual changes in the testicular activity of this fish, no work has so far been published in Iraq on any other biological aspect of this species. A number of studies, however, have been published on age and growth of some other species of *Barbus* in Iraq (Al-Hamid, 1966 ; Al-Hamid, 1972 ; Ahmed, 1974 ; Al-Jaryan, 1974). The present work is an attempt to describe mathematically the growth of *Barbus luteus.*

## *MATERIALS AND METHODS*

A total of 232 fish were collected from Tharthar Reservoir beteewn June and November 1971. The reservoir (Fig. 1) is situated in a place between the two great rivers of Iraq, the Tigris and the Euphrates and about 65 Km. North West of Baghdad. It is connected to the Tigris by

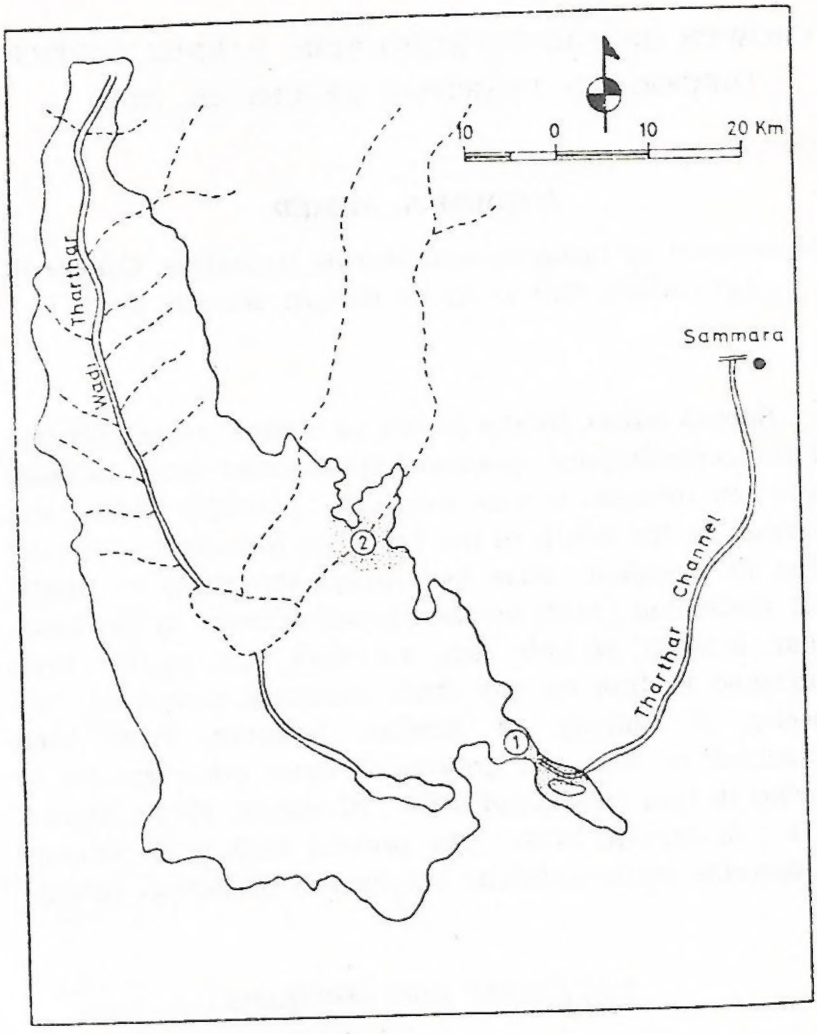


Fig. 1. Monthly distribution of primary moult in *Turdoides altirostris* : more than one feather moult in a bird is connected with dots. N : no sign of primary moult, C : primary moult completed, J : juvenile, I : adult

a 65 Km long man-made channel starting from Sammarra dam in Salah Al-Deen district in order to get rid of the devastating effects of the flood. It is roughly 100 Km in length and about 40 Km in width, the total area being 2050 square Km (Irrigation department report, 1954) and the potential storage capacity 72.8 thousand million cubic meters.

The reservoir is connected to the Euphrates so that the excess water from the former can be passed out to the latter.

Samples were collected from two stations (Fig. 1). Gillnets with a mesh size ranging between 1.5 and 5 cm sq. were used for collection. Due to the difficulty in separating the sexes morphologically and also because the sample size was not very large, sexes were combined. Five to ten scales were collected from the region between the dorsal scales from each envelope were chosen and these were in gm of all fiish were measured. The scales from each fish were kept in envelope on which the pertinent data (date of capture, total length and weight) were recorded. In the laboratory the scales were cleaned using tap water and by rubbing between the thumb and the fingers. Three scales from each envelope were chosen and these were mounted between two glass slides, then magnified 35 times using Scale Projector. A strip of paper made for the most clear one was fixed to the 'focus' of the scale. The annuli and the scale margins were marked on that paper strip for further determination of lengths for back calculation. This method have been successfully applied on the scales of other Iraqi fish by Ahmed (1974) and Al-Jaryan (1974). Annuli were not clear on some of the scales which were therefore discarded.

Growth has been described here in terms of length, and using 212 fish, weight length relationship determined by the least square method.

Although growth equations have been applied and summarized by different workers (Beverton & Holt, 1957 ; Tesch, 1968) the one most commnly applied to fish is that of Von Bertalanffy (1938, 1957). So in the present study this method has been followed.

The equation has the common form

$L_t = L\infty [1 - e - K (t-t_o)]$

Where $L_t$ = total length at time t

$L\infty$ = the lengts as age approaches infiinty, or the maximum size toward which the length of fish is tending.

K = Constant, which is a measure of the rate at which length approaches L

$t_o$ = a parameter indicating the hypothetical time at which the fish size would be zero if it had always grown according to the above equation.

To obtain the parameters $L\infty$ and K from a Ford-Walford plot (Ford, 1933, Walford, 1946) annual mean lengths at each age group were required. These were obtained from the back calculations.

## *RESULS*

Fish ranged from 76 mm to 345 mm in total length averaging 222 mm. Weights ranged from 5.4 gm to 501 gm with a mean weight of 219.2 gm.

The results of the present study have been summarized in three tables and one figure.

Separate weight-length relation was not determined for males and females in the present study because of the small size. So the weight-length relationship of *Barbus lutues* with both the sexes combined has been described by the following equation obtained by fitting a straight line by least squares to the logarithms of the average lengths and weights of fish in successive 1 cm length groups.

$$\text{Log}_e W = -4.3383 + 3.010 \text{ Log } L$$

$$\text{or } W = 0.013\ L^{3.01}$$

where W = weight of fish in gm

and L = length of fish in mm

The above equation fits the data fairly. The mean lengths, mean weight and calculated weights for the different length groups have been shown in Table 1.

Calculated lengths of the different age groups obtained by back calculations together with the annual mean length of each age group are shown in Table 2. A decrease in the lengths of younger fish calculated from successively older age groups was evident in this study.

Fig. 2 shows the Ford-Walford plot for this species. When $L_{t+1}$ was plotted against $L_t$, the straight line intersects a line drawn at 45° through the zero point. The ultimate length $L_\infty$ was determined as the point where the curve intersects this 45° line.

Table 1

Observed and calculated weights for the different 1 cm length groups of *Barbus luteus* in Tharthar Reservoir.

| Length group | No. of fish | Mean length | Mean weight | Calculated weight |
|---|---|---|---|---|
| 7 - 7.9 | 5 | 7.6 | 5.6 | 5.8 |
| 8 - 8.9 | 9 | 8.4 | 8.4 | 7.9 |
| 9 - 9.9 | 8 | 9.3 | 10.4 | 10.8 |
| 10 - 10.9 | 11 | 10.3 | 14.0 | 14.6 |
| 11 - 11.9 | 6 | 11.4 | 19.0 | 19.8 |
| 12 - 12.9 | 10 | 12.3 | 24.9 | 24.9 |
| 13 - 13.9 | 7 | 13.3 | 29.3 | 31.6 |
| 14 - 14.9 | 3 | 14.1 | 39.7 | 37.6 |
| 15 - 15.9 | 3 | 15.5 | 44.3 | 50.1 |
| 16 - 16.9 | 2 | 16.3 | 51.5 | 58.3 |
| 17 - 17.9 | 3 | 17.7 | 78.0 | 74.7 |
| 18 - 18.9 | 5 | 18.4 | 81.4 | 84.0 |
| 19 - 19.9 | 2 | 19.3 | 111.5 | 97.0 |
| 20 - 20.9 | 3 | 20.2 | 113.6 | 111.2 |
| 21 - 21.9 | 3 | 21.2 | 131.0 | 128.7 |
| 22 - 22.9 | 15 | 22.4 | 166.2 | 152.0 |
| 23 - 23.9 | 4 | 23.3 | 159.7 | 171.0 |
| 24 - 24.9 | 9 | 24.5 | 211.8 | 199.0 |
| 25 - 25.9 | 8 | 25.4 | 224.0 | 221.8 |
| 26 - 26.9 | 6 | 26.5 | 250.7 | 252.1 |
| 27 - 27.9 | 8 | 27.3 | 276.0 | 275.7 |
| 28 - 28.9 | 11 | 28.3 | 309.4 | 307.3 |
| 29 - 29.9 | 7 | 29.2 | 322.0 | 337.7 |
| 30 - 30.9 | 15 | 30.5 | 395.0 | 385.1 |
| 31 - 31.9 | 13 | 31.4 | 400.7 | 420.3 |
| 32 - 32.9 | 14 | 32.4 | 467.0 | 462.0 |
| 33 - 33.9 | 14 | 33.4 | 489.0 | 506.3 |
| 34 - 34.9 | 8 | 34.3 | 498.0 | 548.5 |

Table 2

Mean lengths at the end of each year of life of various age groups and annual meanth length of *Barbus luteus*.

| Age group | No. of fish | Year of life | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| I | 8 | 7.8 | | | | | | |
| II | 23 | 8.5 | 16.4 | | | | | |
| III | 35 | 8.9 | 17.3 | 21.6 | | | | |
| IV | 59 | 8.2 | 15.2 | 20.9 | 25.2 | | | |
| V | 55 | 7.4 | 14.3 | 19.7 | 23.8 | 28.0 | | |
| VI | 29 | 8.0 | 16.1 | 20.0 | 24.9 | 30.2 | 32.8 | |
| VII | 1 | 7.9 | 15.9 | 20.4 | 24.3 | 28.1 | 30.7 | 32.3 |
| Annual mean length | | 8.1 | 15.9 | 20.5 | 24.5 | 28.8 | 31.7 | 32.3 |

The equation obtained was

$$L_t = 38.0\ [(1 - e^{-0.29\ (t\ -\ 0.20)}]$$

Table 3 gives the observed annual mean lengths taken from Table 2 and the annual mean lengths calculated by using the above equation. The two sets are very close to each other indicating the equation fits the data adequately. As the data indicate the fish showed a progressive increase in calculated length with increasing age.

## *DISCUSSION*

Maximum length attained by this species calculated in this paper (38.0 cm) indicates that unlike many other *Barbus* species, *B. luteus* don not reach very large sizes. Although growth has not been mathematically calculated for other *Barbus* species of Iraq, data given by Ahmed (1947) and Al-Jaryan (1974) shows that other *Barbus* species like *B. xanthopterus, B. grypus* and *B. esocinus* live longer and attain a much larger sizes (Table 4).

The n-value of 3.01 obtained for *B. luteus* indicate that its growth pattern is more or less isometric and the fish maintains specific gravity during the life. In this aspect growth does also shows some differences from other *Barbus* species living in the Tharthar Reservoir. The n-value obtained by Ahmed (1974) for *B. esocinus* was 2.861 and those obtained by Al-Jaryan (1974) for *B. xanthopterus* and *B. sharpeyi* were 2.843 and 2.212 respectively. It is however very near the n-value obtained by Ahmed (1974) for *B. grypus* (2.989).

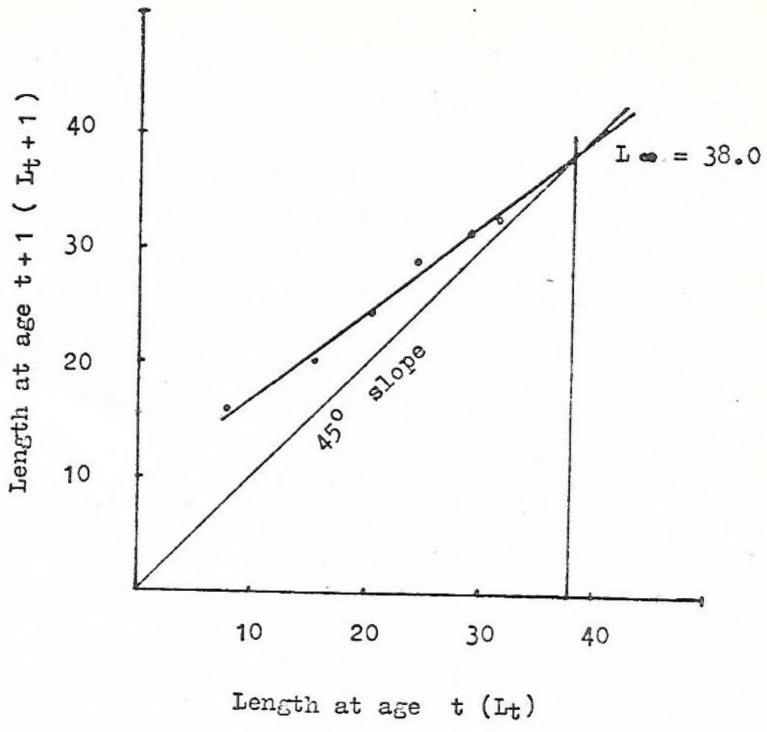


Fig. 2. Ford-Walford plot for *Barbus luteus*.

Table 3. Observed and calculated annual mean length of *Barbus luteus* in Tharthar Reservoir.

| Age in years | Observed length (cm) | Length calculated by Von Bertalanffy eq. |
|---|---|---|
| 1 | 8.1 | 7.9 |
| 2 | 15.9 | 15.4 |
| 3 | 20.5 | 21.1 |
| 4 | 24.5 | 25.4 |
| 5 | 28.8 | 28.5 |
| 6 | 31.7 | 30.9 |
| 7 | 32.3 | 32.7 |

Table 4

Comparison of the growth of different *Barbus* species living in Tharthar Reservoir.

| Species | Length (cm.) at age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| *Barbus grypus** | 16.2 | 25.2 | 33.9 | 41.0 | 46.0 | 52.1 | 58.5 | 68.1 | 78.5 | 81.5 | 88.3 |
| *Barbus esocinus** | 19.6 | 28.2 | 36.3 | 43.5 | 53.0 | 62.3 | 73.3 | 79.0 | 81.9 | 87.5 | |
| *Barbus xanthopterus*** | 12.8 | 22.1 | 28.4 | 34.2 | 39.5 | 44.6 | 49.6 | 54.4 | 59.8 | 64.3 | |
| *Barbus sharpeyi*** | 12.8 | 21.4 | 28.2 | 35.3 | 42.5 | 47.1 | 53.3 | 57.8 | | | |
| *Barbus luteus* | 8.1 | 15.9 | [illegible] | 24.5 | 28.8 | 31.7 | 32.3 | | | | |

* calculated from data of Ahmed, 1974;

** Al-Jariyan, 1974.

## *SUMMARY*

Growth of the Cyprinid fish, *Barbus luteus* (Heckel) locally known as "Himri" was studied. Fish was taken from the Tharthar reservoir in Iraq. The growth equation based on a total of 232 fish was as follows :

$$L_t = 38.0\ (1 - e^{-0.29\ (t-0.20)})$$

The weight-length relationship based on 212 fish was described by the following equation which indicates an isometric pattern of growth :

$$W = 0.013\ L^{3.01}$$



## الخلاصة

تمت دراسة نمو أسماك الحمرى *Barbus luteus* (Heckel) المجموعة من خزان الثرثار ، العراق . كانت معادلة النمو التي استخرجت بالاعتماد على ٢٣٢ سمكة هي :

$$L_t = 38.0\ (1 - e^{-0.29\ (t-0.20)})$$

استخرجت أيضا علاقة الوزن بالطول بالاعتماد على ٢١٢ سمكة وكانت كالتالي :

$$W = 0.013\ L^{3.01}$$

مما يدل على أن نمو هذه الاسماك قياسي

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